PART I - ADMINISTRATIVE

Section 1. General administrative information

Title of project

Satus Watershed Restoration

BPA project number: 9603501
Contract renewal date (mm/yyyy): 04/2000 ☐ **Multiple actions?**

Business name of agency, institution or organization requesting funding
Yakama Indian Nation

Business acronym (if appropriate) YIN

Proposal contact person or principal investigator:

Name	Lynn Hatcher, Fisheries Program Mangager
Mailing Address	P.O. Box 151
City, ST Zip	Toppenish, WA. 98948
Phone	(509) 865-6262
Fax	(509) 865-6293
Email address	yinfish@yakama.com

NPPC Program Measure Number(s) which this project addresses
7.6A-D, 7.8A, B, E

FWS/NMFS Biological Opinion Number(s) which this project addresses

Other planning document references
Strategies 2-7 for steelhead, yakima subbasin Plan, 1990.
Wy Kan Ush Me Wa Kush Wit, Yakima River Subbasin Plan, basinwide recommendations 3-5, pp. 58-59.

Short description
Enhance and protect summer steelhead spawning and rearing habitat by restoring the ecological function of the Satus Creek watershed.

Target species
Yakima River summer steelhead

Section 2. Sorting and evaluation

Subbasin
Yakima River

Evaluation Process Sort

CBFWA caucus	Special evaluation process	ISRP project type
Mark one or more	If your project fits either of these	Mark one or more categories

caucus	processes, mark one or both	
☒ Anadromous fish ☐ Resident fish ☐ Wildlife	☐ Multi-year (milestone-based evaluation) ☒ Watershed project evaluation	☐ Watershed councils/model watersheds ☐ Information dissemination ☒ Operation & maintenance ☐ New construction ☐ Research & monitoring ☒ Implementation & management ☐ Wildlife habitat acquisitions

Section 3. Relationships to other Bonneville projects

Umbrella / sub-proposal relationships. List umbrella project first.

Project #	Project title/description
20547	Yakima Subbasin Habitat/Watershed Project Umbrella
926200	Yakama Nation Riparian/Wetlands Restoration Project
9803300	Restore Upper Toppenish Creek Watershed
9705300	Toppenish-Simcoe Instream Flow Restoration and Assessment
9705100	Yakima Basin Side Channels
9705000	Little Naches Riparian and In-Channel Restoration
9803400	Reestablish Safe Access Into Tributaries of the Yakima Subbasin
9901300	Ahtanum Creek Watershed Assessment
20117	Yakima Subbasin Assessment (new)

Other dependent or critically-related projects

Project #	Project title/description	Nature of relationship
	Yakima/Klickitat Fisheries Project Umbrella	dependence of supplementation on habitat carrying capacity

Section 4. Objectives, tasks and schedules

Past accomplishments

Year	Accomplishment	Met biological objectives?
97	Dike removal	2) Reduce erosion, 3) restore natural riparian vegetation 5) improve aquatic habitat
98	Road obliteration	2) Reduce erosion, 3) restore natural riparian vegetation 5) improve aquatic habitat
97	Boulder placement	5) Improve aquatic habitat
96-8	Grazing (rest/management)	1) Reduce ratio between peak and low flows, 2) reduce erosion, 3) restore natural riparian vegetation 5) improve aquatic habitat
96-8	Fire rehabilitation	2) Reduce erosion, 3) restore natural riparian vegetation, 5) improve aquatic habitat

96-8	Revegetation	1) Reduce ratio between peak and low flows, 2) reduce erosion, 3) restore natural riparian vegetation, 4) develop and assess large-scale, low input restoration treatments, 5) improve aquatic habitat
96-8	Meadow restoration	1) Reduce ratio between peak and low flows, 2) reduce erosion, 3) restore natural riparian vegetation, 4) develop and assess large-scale, low input restoration treatments, 5) improve aquatic habitat
97-8	Large woody debris placement	2) Reduce erosion, 3) restore natural riparian vegetation 5) improve aquatic habitat
97	Aspen regeneration	3) restore natural riparian vegetation, 5) improve aquatic habitat

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Restore natural riparian and upland vegetation patterns.	a	Restore grass and woody vegetation in areas critical to watershed function
	* Note, several tasks adress multiple objectives.	b	Continue the patrol and maintenance of range fences in the Satus Creek watershed
		g	characterize stream habitat conditions throughout the Satus watershed
		i	Experimental treatment development and evaluation.
		j	Large woody debris placements
		k	Enhance beaver habitat by propagating riparian hardwoods
		l	Plant scattered ponderosa pine seedlings
		m	Rehabilitate incised ephemeral and intermittent channels
		n	Reintegrate fire as a landscape process
2	Reduce erosion	a	Restore grass and woody vegetation in areas critical to watershed function
		b	Continue the patrol and maintenance of range fences in the Satus Creek watershed
		i	Experimental treatment development and evaluation.
		j	Large woody debris placements
		k	Enhance beaver habitat by propagating riparian hardwoods
		l	Plant scattered ponderosa pine seedlings
		m	Rehabilitate incised ephemeral and intermittent channels
		n	Reintegrate fire as a landscape process
3	Moderate flow regime on fish bearing streams	a	Restore grass and woody vegetation in areas critical to watershed function
		i	Experimental treatment development and evaluation.
		j	Large woody debris placements
		k	Enhance beaver habitat by propagating

			riparian hardwoods
		m	Rehabilitate incised ephemeral and intermittent channels
		n	Reintegrate fire as a landscape process
4	Improve aquatic habitat	a	Restore grass and woody vegetation in areas critical to watershed function
		i	Experimental treatment development and evaluation.
		j	Large woody debris placement
		k	Enhance beaver habitat by propagating riparian hardwoods
		l	Plant scattered ponderosa pine seedlings
		m	Rehabilitate incised ephemeral and intermittent channels
		n	Reintegrate fire as a landscape process
5	Develop and assess large-scale, low-input restoration treatments, and disseminate findings in appropriate venues	i	Experimental treatment development and evaluation
6	Monitor and evaluate cost-effectiveness of restoration treatments	c	Characterize and quantify streamflow
		d	Characterize suspended sediment transport
		e	Climatological monitoring
		f	Channel survey
		g	Characterize stream habitat conditions throughout the Satus watershed
		h	Fisheries survey

Objective schedules and costs

Obj #	Start date mm/yyyy	End date mm/yyyy	Measureable biological objective(s)	Milestone	FY2000 Cost %
1	4/2000	4/2005	restore natural riparian and upland vegetation patterns	Reduced erosion on unstable upland sites and increased abundance and diversity of riparian vegetation	25.00%
2	4/2000	4/2005	reduce erosion	Substantial decrease in turbidity	25.00%
3	4/2000	4/2005	moderate the flow regime on fish bearing streams	Increased summer baseflows	25.00%
4	4/2000	4/2005	improve aquatic habitat	Measurable improvement in habitat quality and utilization	15.00%
5	4/2000	4/2005	develop and assess large-scale, low-input restoration treatments, and disseminate findings in appropriate venues	Technical publications and presentations	10.00%
				Total	100.00%

Schedule constraints
Unfavorable climatic conditions are the foremost constraints on accomplishing objectives. At present, we are uncertain what affect the Endangered Species Act will have on project activities.

Completion date
2004

Section 5. Budget

FY99 project budget (BPA obligated): $500,000

FY2000 budget by line item

Item	Note	% of total	FY2000
Personnel	Includes a total of 2.4 fte professional staff, 3.5 fte technicians, and .25 fte bookkeeper	%40	202,160
Fringe benefits	25.3%	%10	51,146
Supplies, materials, non-expendable property	Includes: seed, erosion control supplies, fence materials, miscellaneous field supplies.	%8	41,900
Operations & maintenance	Includes: Building rental, utilities, vehicles + maintenance, heavy equipment rental, insurance,etc.	%19	93,795
Capital acquisitions or improvements (e.g. land, buildings, major equip.)		%0	0
NEPA costs		%0	0
Construction-related support		%0	0
PIT tags	# of tags:	%0	0
Travel	Travel for various symposia, workshops, etc.	%1	7,000
Indirect costs	23.5%	%19	93,695
Subcontractor	Cattele impoundment	%3	12,700
Other		%0	0
TOTAL BPA FY2000 BUDGET REQUEST			$502,396

Cost sharing

Organization	Item or service provided	% total project cost (incl. BPA)	Amount ($)
Washington State Department of Transportation	Collaboration on U.S. HWY 97 segement relocation and maintenance mitigation	%0	0
		%0	
		%0	
		%0	
Total project cost (including BPA portion)			$502,396

Outyear costs

	FY2001	FY02	FY03	FY04
Total budget	$400,000	375,000	$110,000	$110,000

Section 6. References

Watershed?	Reference
☒	Beschta, R.L. 1997. Restoration of riparian and aquatic systems for improved aquatic habitats in the upper Columbia River basin. Pages 475-491 in D. Stouter, P.A. Bisson, and R.J. Naiman, eds. Pacific salmon and their ecosystems: status and future opti
☒	Brooks, K.B., P.F. Ffolliott, H.M. Gregersen, and J.L. Thames. 1991. Hydrology and the management of watersheds. Iowa State University Press, Ames, Iowa.
☐	Columbia River Tribal Fish Commission, 1996. Wy-Kan-Ush-Mi-Wa-Kish-Wit, Spirit of the Salmon: The Columbia River Anadromous Fish Restoration Plan of the Nez Perce, Umatilla, Warm Springs, and Yakama Tribes, Volume II. 129 pp. + appendices.
☐	Kauffman, J.B. and W.C. Kreuger. 1984. Livestock impacts on riparian ecosystems and stream management implications: a review. Journal of Range Management 37: 430-437.
☐	Kauffman, J.B., R.L. Case, D. Lytjen, N. Otting, and D.L. Cummings. 1995. Ecological approaches to riparian restoration in northeastern Oregon. Restoration and Management Notes 13:12-15.
☐	Megahan, W.F. 1987. Pages 335-348 in A.S. Balasubramanian et al, eds. Environmental geotechnics and problematic soils and rocks, proceedings of the symposium, December 1985. Balkema, Rotterdam.
☐	National Research Council. 1992. Restoration of Aquatic Ecosystems: Science, Technology, and Public Policy. National Academy Press.
☒	Schuett-Hames, D, A. Pleus, L. Bullchild and S. Hall, eds, 1994. Timber-Fish-Wildlife Ambient Monitoring Program Manual. TFW-AM9-94-001. Northwest Indian Fisheries Commission, Olympia, Washington.

PART II - NARRATIVE

Section 7. Abstract

Satus Creek, contained entirely within the Yakama Indian Reservation, is the most productive steelhead stream in Yakima subbasin, in recent years accounting for more than 1/3 of returning adults. The Satus watershed, comprising approximately 10% of the Yakima subbasin, is largely undeveloped and has no irrigation diversions. This setting offers a unique opportunity to proceed with the landscape-scale restoration and monitoring undertaken by the Yakama Nation Satus Watershed Project. Several major complementary projects, funded by six state and federal agencies, are also underway in the Satus watershed.

The Satus Watershed Project was conceived as a long-term, large-scale watershed restoration and monitoring effort designed to develop, apply, and evaluate cost-effective methods for restoring fish habitat degraded by impaired watershed functioning. This approach was accepted by the BPA, and the project was initiated in June 1996. We are increasing the productivity of anadromous fish habitat by restoring ecological function of the Satus Creek watershed (Brooks et al. 1991; FWP 1995). Restoration activities will also favor riparian dependent wildlife species and reestablishment of coho and spring chinook. Coordinated projects are addressing stream channel stability and complexity, riparian structure, diversity and productivity, and upland source areas

This proposal outlines specific restoration and monitoring tasks which will effect improvements in ecological function. Project staff work closely with BIA and Tribal programs to assure that management activities in the watershed will be complementary. An extensive monitoring system is in place, quantifying the value of coordinated watershed-scale restoration.

Section 8. Project description

a. Technical and/or scientific background

Rising from the rainshadow of the Cascade Mountains, the 612 square mile Satus Creek watershed comprises nearly ten percent of the Yakima River basin and lies wholly within the Yakama Indian Reservation. The two largest tributaries to Satus Creek are Dry Creek (158 square miles) and Logy Creek (109 square miles). Approximately 75% of the watershed is comprised of shrub-steppe rangelands, with most of the balance in forest. Satus Creek begins at an elevation of 5,500 feet on the north slopes of the Simcoe mountains, near the south boundary of the Yakama Indian Reservation, and flows northeasward to the lower Yakima Valley.

Satus Creek and its tributaries are the most significant remaining natural production areas for the declining population of Yakima River steelhead. The Satus Creek summer steelhead run has accounted for as much as half the production in the Yakima River basin in recent years. This population has suffered a serious decline since monitoring began in 1988. This trend is unlikely to reverse itself soon, judging by the low outmigrations of summer steelhead smolts from the Yakima Sub-Basin in recent years. Poor smolt production also indicates that spawning and rearing conditions are limiting steelhead populations. Management of this watershed has profound implications for the Satus Creek steelhead run and, in turn, for the entire Yakima Basin run. We are, in fact, “protecting the best”.

b. Rationale and significance to Regional Programs

The long term goal of the Yakama Indian nation is to restore summer steelhead to harvestable levels, while maintaining the genetic integrity and adaptability of the population. The Yakima Subbasin Plan outlined in Volume II, *Wy-Kan-Ush-Mi-Wa-Kish-Wit*, establishes a summer steelhead adult return goal of 29,700 for the entire sub-basin. This will involve restoring terrestrial and aquatic habitat to conditions capable of supporting all freshwater life history stages of summer steelhead.

As noted in the FWP, “improv[ed] habitat quality [is] needed to increase the productivity of many stocks. Reduced habitat quality results in lower survival during critical spawning, incubation, rearing and migration periods… Improved habitat quality would allow greater juvenile and adult survival at each freshwater life stage and can result in more offspring surviving to begin migration to the ocean”. Analysis of data collected indicates a suite of changes to the functioning of the Satus Creek watershed over the last 50 years. These changes include vegetative changes across the watershed, increased drainage density, extensive road construction, stream diking and channelization, removal of large woody debris, channel changes (i.e., straightening, widening/bank erosion, channel incision, braiding), changes in the structure and composition of riparian vegetation, and a more extreme flow regime. While some of the observed habitat degradation is attributable to local disturbance, is our working hypothesis that aquatic habitat is created by the watershed-scale interactions between water, soil, and vegetation. It follows that changes to these interactions will cause changes to the habitat. The altered, more extreme flow regime identified by watershed analysis in the Satus watershed, accompanied by wide-spread habitat degradation not attributable to on-site disturbances, is indicative of impaired watershed functioning as a cause of the habitat degradation. This view of aquatic conditions being influenced by upland conditions is supported by the FWP: “Maintaining and improving the productivity of salmon and steelhead habitat… requires coordination of virtually all activities that occur in a subbasin… [I]f watershed restoration is to be successful, instream restoration should be accompanied by riparian and upslope restoration. A comprehensive watershed approach can help fisheries resources recover from their depressed state”. The

Satus Watershed, by virtue of being under single ownership, and in a largely undeveloped state offers a nearly ideal opportunity to translate this perspective into action.

FWP 7.6A Habitat Goal: Protect and improve habitat conditions to ensure compatibility with the biological needs of salmon, steelhead and other fish and wildlife species. Pursue the following aggressively.
7.6A.1 Ensure human activities affecting production of salmon and steelhead in each subbasin are coordinated on a comprehensive management basis.
The Satus Creek watershed is a vital element in the Yakima River subbasin. The scope of this project includes, to a large degree, coordinating human activities throughout most of the watershed, and throughout all the steelhead spawning and rearing habitat in the watershed.
7.6A.2 At a minimum, maintain the present quantity and productivity of salmon and steelhead habitat. Then, improve the productivity of salmon and steelhead habitat critical to recovery of weak stocks. Next, enhance the productivity of habitat for other stocks of salmon and steelhead. Last, provide access to inaccessible habitat that has been blocked by human development activities.
Aquatic habitat in the Satus Creek watershed is being protected through the previously-mentioned grazing exclosures and leases (Kauffman and Kreuger 1984, Kauffman et al. 1995). Additionally, habitat is being directly improved through relocation of floodplain road sections (Megahan 1987), removal of dikes, riparian revegetation (Beschta 1994), addition of large woody debris (National Research Council 1992), and reconnection of high flow channels. Restoration treatments aimed at restoring watershed functioning include headwater meadow restoration, beaver habitat improvement, revegetation, and prescriptions for controlled burning. Future activities will address implementing planning and implementation of additional progressive grazing management, wild horse management planning and implementation, road drainage improvements, additional revegetation, and headwaters restoration.

c. Relationships to other projects

The Satus Project is collaborating with a number of agencies and tribal programs, as well as related restoration projects including:

1. The BPA-funded Yakima Fisheries Project's goal is to increase natural production of salmon and steelhead. Habitat improvements in the Satus Creek watershed support this goal.

2. The Yakama Nation's Lower Yakima Valley Wetlands and Riparian Area Restoration Project (926200) is receiving $ 1.5 million annually from the Bonneville Power Administration to purchase, restore and manage riparian lands along the Yakima River, lower Toppenish Creek, and in lower Satus Creek. These efforts are coordinated with and support the goals of the Satus Watershed Project.

3. The Bureau of Indian Affairs funded a watershed analysis and a large headwater restoration project in FY97. The analysis, now complete, has been the guiding document for Satus Creek restoration efforts and the headwater project was designed and implemented in close coordination with Satus Project staff.

4. The Federal Emergency Management Agency has provided funding to repair roads damaged during the flood of February 1996. Satus Project staff took the lead role in this project in order to meet FEMA and transportation requirements while furthering restoration efforts. This project was completed in November 1998.

5. Satus staff are currently working closely with Washington State Department of Transportation on a mitigation plan for original construction/maintenance impacts of U.S. HWY 97 and a proposed realignment of a segment of the highway.

6. We are initiating a collaborative effort with the area BPA right-of-way maintenance crew to minimize the affects of right-of-way maintenance activities on Satus Creek and its tributaries.

d. Project history (for ongoing projects)

The Satus Watershed Project was initiated as an early implementation project in July, 1996. An extensive monitoring network was established for the measurement of climate and streamflow. Development of these records create the opportunity to track the relationships between climatic input and watershed output so changes in watershed functioning can be identified. Although this intensity of watershed monitoring is not generally justified, it was included in this project because the unique cost-sharing opportunities and the ability to perform watershed-scale restoration treatments. Concurrent fisheries population and habitat monitoring has been conducted to identify baseline populations and conditions.

Restoration treatments performed to-date include:

- Dike removal. We have removed approximately 2,000 linear feet of dikes from the banks of the highest quality spawning and rearing reach of Satus Creek. The larger material was used to construct sills with the objective of reconnecting high flow channels and increasing channel/floodplain interactions.
- Road removal. We have decommissioned 4 .4 miles of road located in the floodplain of a key reach spawning and rearing reach of upper Satus Creek. Three large culvert crossings of Satus Creek have been removed; road drainage features have been altered to convert channelized surface flow to subsurface flow, and the road surface was ripped and seeded. An additional 2.2 miles of new road were constructed to provide an alternative route to upper Satus Creek.
- Road relocation. Approximately 1.1 miles of road were relocated from the floodplain of an important spawning reach in Wilson-Charley Creek: a tributary of upper Satus Creek. Three problematic creek crossings were replaced with arched culverts, and the old road was ripped and rehabilitated. Nearly 1 mile of badly eroding road was relocated from a formerly wet meadow in the headwaters of Seattle Creek, a tributary of Dry Creek. The creek crossing was moved to the bottom of the project area and involves a small dam designed to be overtopped during high flows while remaining driveable, much like an elevated ford. Final treatments will take place during the winter 1998/99 through summer 1999.
- Boulders. We treated another section of Satus Creek which had long ago been straightened to accommodate a highway by blasting a new channel through bedrock. We revegetated a fillslope prone to surface erosion, and placed boulders in the artificial channel to harbor juvenile and migrating adult steelhead.
- Gravel. A 15,000 cubic yard rock crushing operation was completed in December, 1997 to provide road surfacing material at stream crossings and other locations which contribute fine sediment to Satus Creek and its tributaries.
- Grazing. We are resting approximately 40% of the Satus Creek watershed from cattle grazing. This effort began in 1995 with the Satus Creek corridor, and was expanded to Logy Creek and uplands surrounding both streams in 1996. In 1997 we began a system of regular patrols, contacting ranchers or moving cattle ourselves to minimize trespass. We have collaborated with the BIA Range Management Program to restructure the grazing system on Range Unit 17, which includes all of the North Fork and mainstem of Dry Creek, and the upper Middle Fork. This strategy will remove livestock from the Dry Creek sub-watershed during most of the critical growing season for riparian/wetland plants. This program was initiated in April 1998.
- Fire rehabilitation. Following forest and range fires in the Satus Creek drainage in 1994, 1996,1997, and 1998, we fenced and revegetated approximately 3,000 acres of burned areas, and mechanically rehabilitated fire lines and other sites associated with suppression efforts.
- Revegetation. 1) Floods in 1996 and 1997 created substantial fresh sediment deposits on the floodplains in the Satus Creek watershed. These areas were broadcast seeded with native grass seed as soon as they became accessible. 2) Experimental treatments were performed in spring 1997 and 1998 with willow propagation. Willow sticks were dumped into Satus and Dry creeks at various locations and differing flows. Other sticks were secured into the bed of point and mid-channel bars. A subsample of sticks from each treatment were marked for monitoring survival rates and transport characteristics. Results are being carefully monitored and methods refined. Final results will be published in an appropriate journal. 3) Experimental treatments were performed with root severing of aspen and cottonwoods to promote a suckering response. These treatments are being monitored. 4) Sedges were transplanted into incised intermittent stream channels to act as seed sources for

downstream propagation. 5) A 1,500 ft. segment of eroding highway roadfill immediately adjacent to Satus Creek has been stabilized and revegetated. 6) 400 ponderosa pine seedlings were planted in strategic locations on the Satus Creek floodplain to provide stream shading and high quality large woody debris in the future.

- Meadow restoration. Incised channels have been treated to prevent further downcutting and headcutting, and to create sufficient stability that natural recovery can proceed. A headwater area of several hundred acres in extent is being cooperatively worked on by personnel funded by a Bureau of Indian Affairs watershed restoration grant, and by Satus Watershed Project personnel. In its third year, this project is beginning to showing significant channel aggradation.
- Large woody debris (LWD) placement. Large windthrown trees, with rootwads attached, have been added to upper Satus Creek, using a combination of helicopter and excavator placement. Large stumps generated during the course of relocating the Wilson-Charley road (above) have been placed into Wilson-Charley Creek to improve hydraulic complexity.
- Aspen regeneration. Aspen is in decline across the landscape due to changes in the disturbance regime which have severely reduced regeneration. As the preferred beaver fodder, its decline has reduced beaver habitat. We have removed encroaching conifers in many of the aspen stands in the Satus Creek watershed, and will be applying treatments such as prescribed fire to stimulate propagation.

Adaptive management is central to achieving the Satus Watershed Project's restoration goals. Because the basin is entirely under the ownership of the Yakama Indian Nation and the YIN Fisheries Program is holding 5 year grazing leases for 40% of the basin, a unique opportunity exists to apply adaptive management. Small-scale, high-intensity restoration activities may be appropriate where acute problems exist (e.g. dikes), however, our restoration philosophy is to develop and apply large-scale, low input restoration techniques which are compatible with sustained economic land use, and which capitalize on natural processes and seasonal opportunity. Based on analysis of historical data, we are learning how land uses have contributed to fish habitat degradation. This provides a historical context for present day adaptive management prescriptions that integrate watershed restoration and continued land management practices such as livestock grazing, forest management, and prescribed burning. As the art and science of true watershed restoration is in its infancy, developing new restoration techniques with broad applicability is critical not only to the success of this project, but to many projects in the Columbia Basin.

e. Proposal objectives

The Yakama Indian Nation proposes to improve fish habitat in the Satus Creek watershed by ameliorating the effects of past and present land uses. Our measurable objectives are:

1. restore natural riparian and upland vegetation patterns,

2. reduce erosion,

3. moderate the flow regime on fish bearing streams,

4. improve aquatic habitat,

5. develop and assess large-scale, low-input restoration treatments, and disseminate findings in appropriate venues, and

6. Monitor and evaluate cost-effectiveness of restoration treatments.

Because this project is founded on the assumption that aquatic habitat is a function of watershed-scale interactions between soil, water, and vegetation, some objectives listed are intended as indicators of the functionality of those interactions. These watershed-scale processes will not change quickly, hence the monitoring of watershed functioning is intended to be a long-term effort.

Interim Products:

Annual reports on the activities undertaken, and summary of monitoring data collected and analyzed in the course of this project; publication of research findings; presentations at relevant symposia.

f. Methods

Following are the tasks we are undertaking:

A. Restore grass and woody vegetation in areas critical to watershed function We will continue seeding and planting eroding or sensitive uplands and riparian/wetland areas with appropriate native grass, shrub, and tree species. Our focus is directed toward reestablishing natural vegetative patterns and complexity in key areas of the watershed, especially floodplains, headwater source areas, and eroding uplands. (Objectives 1, 2, 3, 4, and 5)

B. Continue the patrol and maintenance of range fences in the Satus Creek watershed. We currently patrol and assist with fence maintenance on all rangelands and stream corridors we manage under this project. The project has a full-time technician dedicated to this task monitoring range units daily. This continuing task ensures secure boundaries for recovering areas, preventing new damage caused by livestock trespass. (Objectives 6)

C. Characterize and quantify streamflow. We have established eleven permanent stream gaging stations to continuously measure stream discharge for Satus Creek and its two largest tributaries, Dry and Logy creeks. This information will be used to assess changes in the timing and quantity of flows, in relation to climatic conditions, and to conduct flood frequency analysis. We are using a set of staff gages and discharge measurements to characterize the flow regimes of several intermittent streams. A long-term record of streamflow is vital to identifying changes in watershed functioning. (Objectives 6)

D. Characterize suspended sediment transport. We are taking regular turbidity measurements at all stream gaging sites and at other selected locations throughout the watershed. This information will be used in combination with flow data to monitor changes in the relationship between flow and suspended sediment. (Objectives 6)

E. Climatological monitoring. We have established ten permanent climate stations which continuously monitor precipitation and temperature across the watershed. This information will be used monitor changes in precipitation-streamflow relationships. The new information is being added to the data set used in the watershed analysis, which included historical information dating back to 1910, in order to refine long term changes in the precipitation-streamflow relationship. (Objective 6)

F. Channel survey. We will resurvey channel cross-sections and profiles on major perennial streams in the Satus Creek watershed to evaluate channel response to high flows and restoration treatments. This task will allow very precise monitoring of stream channel change in both the short and long-term. (Objective 6)

G. Characterize stream habitat conditions throughout the Satus watershed. Specific stream segments (approximately 1500') have been selected following standard Washington State ambient habitat monitoring protocols (TFW). A long-term stream segment monitoring strategy includes aerial photo interpretation, channel surveying, channel habitat unit classification, and measurements of canopy coverage, bank stability, gravel embeddedness, large woody debris frequency, temperature, and water quality. Initial monitoring of the selected stream segments has been largely completed. These stream segments will also be targeted for site specific restoration efforts, including those detailed in this methods section (e.g. re-vegetation, burning, large woody debris placements). (Objective 6)

H. Fisheries surveys. Quantify target fish population characteristics and habitat specific biological responses, including abundance, density, growth, and condition of life history cohorts from young-of-the-year fry to migrating smolts, including parr stages. Population characteristics and cohort

fate will be compared within and among watershed tributaries. Population sampling has been conducted with electrofishing techniques within the stream habitat monitoring segments, as outlined above. Smolts have been sampled in the lower Satus Creek area, below all contributing tributaries, to obtain an estimate of overall Satus watershed steelhead production. The redds of spawning adults were surveyed between March and the first half of May, 1997, as in the past, to track overall population trends and identify important spawning reaches for purposes of future conditions analysis (e.g., fine sediment composition). Analysis of monitoring will be performed using the standard procedures established by the TFW Ambient Monitoring Program. (Objective 6) Continuation of these monitoring protocols will be needed to evaluate the success of the restoration treatments being applied.

I. Experimental treatment development and evaluation. Experimental watershed treatments will be performed on small subwatersheds, and monitored using appropriate combinations of measurements, including: stream gaging, precipitation gaging, channel and floodplain characteristics, vegetative response, and monitoring of survival and growth of juvenile steelhead. This small-scale intensive monitoring allows us to assess the cost effectiveness of individual treatments and applicability for adaptive management in other watersheds. (Objectives 1, 2, 3, 4, 5, and 6)

J. Large woody debris placements. Insufficient large woody debris (LWD) has been identified by watershed analysis as a factor in channel instability, low channel complexity, and inadequate cover throughout a large portion of the fish bearing stream system. We are using a variety of means to increase LWD in the short and long term. In reaches identified as critical spawning and rearing habitat, we have used a helicopter and an excavator to place windthrown trees in the creek. Additionally, we have used the excavator to reposition into the active channel LWD stranded on the floodplain by recent extreme high flows; we will do more of this work in the near future. Large nearby stumps left in the aftermath of road construction or timber sales will also be strategically placed in streams to increase hydraulic complexity. Also, where accessible, and where instream structure is entirely absent, small clusters of wood posts will be pounded into the streambed to provide locations for the initiation of debris jams. Several of the LWD placements are located within habitat survey segments, thus data have been collected on fish population abundance and density prior to placement; monitoring consists of intensive survey with a laser total-station combined with fish population and habitat protocols at each site to asses local effects on fish habitat, persistence or downstream/off-channel transport of large woody debris as well as cost-effectiveness and applicability to other sites. (Objective 2, and 5)

K. Enhance beaver habitat by propagating riparian hardwoods. The loss of water and sediment storage behind beaver dams was identified in the watershed analysis as a contributing factor in the degradation of anadromous fish habitat. We are propagating aspen seedlings in a green house for planting in sites suitable for beaver habitat. GIS and aerial photo interpretation, and a literature review on beaver habitat preference are supporting the identification of potential beaver habitat within the watershed. We are reinvigorating and aiding the reestablishment of riparian cottonwood, willow, and aspen stands throughout the Satus Creek watershed through root severing, removal of encroaching conifers, irrigation of point bars, release of willow sticks under moderately high flow conditions, and prescribed burning. Each site will be monitored with a combination of photo points and cover or density measurements to assess vegetative response and beaver use. (Objectives 1, 2, 3, 4, and 5)

L. Plant scattered Ponderosa pine seedlings throughout the mainstem floodplains of Satus, Dry, and Logy Creeks to recreate historic distribution and enhance long term stream shade, bank strength, and future high quality large woody debris. Plantings will be monitored every other year (for 4 years) to assess establishment and growth rates. (Objective 3, and 5)

M. Rehabilitate incised ephemeral and intermittent channels, especially in headwater meadows. Incised channels around the watershed are being rehabilitated by stabilizing headcuts, constructing sediment traps, and revegetating to stabilize sediments and to promote self-perpetuating channel

aggradation. Headcuts will be evaluated in three years to measure stabilization and headward movement. A subsample of sediment traps will be monitored with erosion pins above the upstream face and permanent line-intercept crossections to track vegetative establishment. (Objective 1, 2, 3, and 5)

N. Reintegrate fire as a landscape process. We will introduce prescribed fire into the Satus Creek basin, with the goals of improving watershed functioning and restoring high quality aquatic habitat. We contracted Dr Steve Bunting and Dr Lee Eddleman to prepare an ecologically-based prescribed burning plan for the rangelands of the Satus watershed. Implementation of this fire reintroduction plan will play a vital role in ongoing long-term restoration efforts. We will begin burning as soon as conditions allow. The in-house analytic and monitoring capabilities of the YIN Department of Natural Resources will allow us to assess the cumulative effects of fire reintroduction on ecosystem functioning and anadromous fish habitat. A combination of methods will be used to assess vegetative response, soil stability, and water quantity and quality changes. (Objective 1, 2, 3, 4, and 5)

With respect to vegetation, streamflow, channel morphology, climate, and fish habitat/populations, The Satus Creek watershed is one of the most intensely monitored watersheds of its size in the western United States. This network gives the Satus Project the unique opportunity to precisely monitor changes to watershed function and anadromous fish habitat/populations at both the site and watershed scales.

Our restoration activities are based on the following assumptions:

1. The stream/riparian ecosystem is an expression (integration) of the functioning of the entire watershed, i.e., the landscape-scale interactions between soil, water, and vegetation.

2. Long-term sustainability of aquatic and terrestrial ecosystems rely on developing land uses which allow the soil-water-vegetation interactions to remain within a natural range of variability.

3. Vegetation is the key to stabilizing soils and moderating the routing of water and sediment through the watershed; manipulation of the vegetation is our primary tool for restoring watershed functioning and normative channel conditions.

4. Our restoration activities will gradually alter the routing of sediment and water through the watershed, returning them to within the range capable of supporting healthy aquatic ecosystems.

Weather is the critical uncertainty associated with the success of our restoration efforts. Various project restoration activities are designed to capitalize on a range of climatic conditions (e.g., high flow periods), however, success in manipulating the vegetation in any given year will still be dependent upon at least moderately favorable weather. The secondary uncertainty lies in the assumption that improving spawning and rearing conditions will increase steelhead numbers in the Satus Creek basin. No single project can encompass the entire steelhead life cycle; this project deals with providing a larger supply of outmigrants to benefit from downstream improvements and accelerate the stock recovery process. Mainstem river and ocean conditions are being addressed by other projects.

g. Facilities and equipment

The Satus Watershed Project has already acquired virtually all the facilities and equipment required to perform most of the tasks listed above. Other special equipment which is infrequently used or too expensive to justify purchasing, such as an excavator, will be leased, rented, or contracted.

h. Budget

Personnel is the most substantial budget item, $ 253,306, for this project. This line item reflects 2.4 FTE's of professional staff including: .15 FTE for the project leader/ fisheries biologist, .75 FTE's for the project managers (hydrologist and watershed restoration biologist), .5 FTE wildlife biologist, .25 FTE fisheries biologist and .04 FTE for a cultural specialist/archaeologist to grant clearances individual projects.

Restoration/monitoring technicians account for 3.5 FTE's and .25 FTE for a bookkeeper. In an effort to share experience and expenses between projects, every member of the Satus staff is being shared with other closely related projects.

Vehicles and office rental will also be shared with the Upper Toppenish Creek Restoration Project. These two projects, in adjacent watersheds, are being implemented by much the same staff, hence the shared costs and space provides better coordination between projects.

Other substantial line items include Supplies and Materials ($ 41,900) which covers seed, fence materials, etc., and Operations and Maintenance ($ 93,795) which provides primarily vehicles and heavy equipment rental/lease. We currently lease 7 vehicles from GSA of which 75% of the cost will be covered by this project.

The Travel line item covers the cost of attending, or presenting findings, at pertinent symposia and meetings, as well as training opportunities for project technicians.

Section 9. Key personnel

GINA RINGER

509) 865-6262, ext. 6647 (W) email: gringer@yakama.com

Education:

M.S., Forest Hydrology, 1994
minor in ecology
Oregon State University

B.S., Civil Engineering, 1979
B.S., Agricultural Engineering,
University of California at Davis

Experience:

Watershed Hydrologist July 1996 - present
Yakama Indian Nation Satus Watershed Project, Toppenish, Washington
Develop and manage the Satus Watershed Project, implementing grants to perform watershed analysis and restoration; designing and supervising the installation of an extensive monitoring network; analyzing streamflow and climate records; planning and supervising the implementation of watershed restoration treatments; interdisciplinary assessment of riparian and upland areas; interdisciplinary watershed analysis and report preparation; hiring personnel; supervising; preparation and administration of contracts; preparation and delivery of presentations; preparation of funding proposals.

Hydrologist October 1994 - July 1996
Yakama Indian Nation Water Program, Wapato, Washington
Evaluate the effects of land use on the surface waters of the Yakama Reservation; advise staff and policy makers; make recommendations on issues involving surface waters; collect and analyze hydrologic data; hydrologic modeling; technical support; interdisciplinary planning of timber sales.

Hydrologist/Civil Engineer May 1994 - September 1994
Washington Department of Fish and Wildlife, Engineering and Technical Support Section of the Habitat Division, Olympia, Washington.
Hydrologic and hydraulic analysis of natural channels; interdisciplinary development of aquatic habitat restoration and flood risk management plans for the Dungeness and Quilcene rivers; verification and improvement of a model specifying design flows for fish passage.

Publications:

Adams, P.W. and G.O. Ringer. 1994. Summary and annotated bibliography of the effects of timber harvesting and forest roads on water quantity and quality in the Pacific Northwest. Oregon Forest Resources Institute.

Awards:

OSU College of Forestry Fellowship.
California State Scholarship**.**

Licenses and Professional Credentials:

Professional Engineer, California, license no. C35359.
Member, Washington State Riparian Proper Functioning Condition (PFC) training cadre.

Thomas H. McCoy

Yakama Indian Nation
Wildlife Resource Management Program
P.O. Box 151
Toppenish, WA. 98948
Wk. (509) 865-6262
e-mail: tmccoy@yakama.com

Education:

M.S. Rangeland Ecology and Watershed Management
Emphasis – Hydrology
University of Wyoming, Laramie
1994

B.S. Business Administration
Emphasis – Management
Washington State University, Pullman
1989

Professional Experience:

Watershed Restoration Biologist / Satus Watershed Project Manager
Yakama Indian Nation, Toppenish, WA.
June 1994 to present

Since June 1996. Served as co-project manager for the Satus Watershed Restoration Project. Duties include: implementing watershed restoration and analysis projects, developing and monitoring restoration treatments, design-install watershed scale climate and streamflow monitoring network, report preparation and presentation, hiring and supervision, preparation and administration of grant proposals, interdisciplinary team member, media liaison.
September 1994 – June 1996. Addressed watershed related management issues on the Yakama Indian Reservation for the YIN Division of Natural Resources including: forestry/timber harvest, range management, riparian/wetlands restoration, and transportation issues. Also temporarily served as the YIN's technical representative to the U.S. Army Yakima Training Center.

Graduate Research Assistant
University of Wyoming, Laramie, WY.
June 1992 – June 1994

Duties in addition to graduate studies and research included: operation and maintenance of the Snowy Range Observatory and Pole Mountain Observatory (both are large groundwater – surfacewater – vegetation interaction research facilities), assisted with numerous other hydrologic and fish habitat restoration research projects

Preserve Ecologist/Manager
The Nature Conservancy, John Day, OR.
Summer 1991

Served as the newly established preserves manager including: design and implement vegetation and channel characteristic monitoring programs, liaison to federal, state, and county agencies, supervision.

Professional Credentials:
Member, Washington State Riparian Proper Functioning Condition (PFC) training cadre.

Section 10. Information/technology transfer

Our restoration philosophy is to develop and apply large-scale, low input restoration techniques which are compatible with continuing current land uses, which capitalize on natural processes and seasonal opportunity, and which will be applicable throughout the Columbia Basin. Based on our interpretation of historical information, we are learning how land uses have contributed to fish habitat degradation. This provides a historical context for present day adaptive management prescriptions that can integrate watershed restoration and continued land use. Biological results from restoration activities focused on watershed functioning, conducted within a framework of long-term monitoring, will be characterized in future reports and technical papers. Project staff will continue to deliver oral and poster presentations, and host field trips to the project area for government agencies and media. Such exposure is increasing proportionally with the visibility of project accomplishments. Lastly, results from experimental treatments will be submitted for publication in appropriate journals.

Congratulations!